International Journal of Power Electronics and Drive System (IJPEDS)
Vol. 10, No. 3, Sep 2019, pp. xx~xx
ISSN: 2088-8694, DOI: 10.11591/ijpeds.v10.i3.pp-pg

Voltage Tracking of Bridgeless PFC Cuk Converter Using PI Controller

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Article Info

Article history:

Received Apr 17, 2019
Revised Jul 22, 2019
Accepted Aug 3, 2019

Keywords:

Bridgeless
Power factor correction
Cuk converter
Control system
Proportional-Integral

ABSTRACT

This paper proposes a Proportional-Integral (PI) control voltage tracking of Bridgeless Power Factor Correction (BPFC) Cuk converter. In order to investigate the behaviour of different output voltages during overshoot, steady state and step response, P.I controller is designed to set the -42 V, -48 V, -54 V output voltages. The simulation results show that the proposed PI controller able to control the output voltage and achieve fast steady state and step response of BPFC Cuk converter. When the value of output voltage increase, the overshoot voltage will become higher but the steady state respond will be faster. Furthermore, BPFC Cuk converter with P.I controller have low output voltage ripples.

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1. INTRODUCTION (10 PT)

Power electronic equipment with an active power factor correction (PFC) for telecom, datacom, and automotive electrical system are becoming necessary nowadays [1][2][3][4][5]. There are several types of DC-DC BPFC converters were developed for PFC applications such as boost, buck, buck-boost, SEPIC and Cuk converters[6]. However, for low power application, BPFC Cuk converter is the most reliable converter because it offers low THD of input current, good power factor, easy to implement in transformer isolation, and natural protection against inrush current from start-up or overload current [7][8][9][10][11]. This converter acts similar to the buck-boost converter since it able to step up and step-down the output voltage by controlling the duty cycle [12][11].

Basically, the DC-DC converter used power semiconductor devices that operated as the electronic switches which are refer as switched mode power supply [SMPS][13][14]. The operation of this switching devices may cause inherently nonlinear characteristic of the BPFC Cuk converter[15]. Pulse width modulation (PWM) is the most popular method for the various switching technique [16][15]. Switch-mode PWM dc–dc converters used to provide a constant output voltage[17]. Proportional-Integral (PI) controller often to use as the control method for PWM switching due to the simple design and easy to implement[18][19].